**South Dakota Agricultural Education (AFNR)**

**Academic Integration Activities**

**ACTIVITY #15**

*Introduction to Agriculture, Food and Natural Resources students will be able to use lines of symmetry to explain plant cell structure, seed type, and how seeds germinate.*

**1. Ag Standard**

Introduction to Agriculture, Food and Natural Resources, ITA 5.1: Explain functions and physiology of cells and seeds.

* Summarize the cellular structure of plants.
* Explain the structure and kinds of seeds.
* Summarize the process of seed germination.

**2. Academic Standard**

9-12.G.2.2: Students are able to reflect across vertical or horizontal lines and translate two-dimensional figures (Application).

* Identify lines of symmetry

**3. Background Information**

A line of symmetry divides a figure into two congruent (similar or matching) halves.

**How to find lines of symmetry**

1. Look for midpoints in the figure

2. Use a ruler to draw a straight line through the estimated midpoint

3. Fold the shape in half to see if both sides match. If they do, it is a line of symmetry.

A rectangle has two lines of symmetry because there are two ways to divide the shape into two congruent halves. A square has four lines of symmetry because there are four lines that divide the figure into two congruent halves. A regular pentagon has five lines of symmetry as shown.

There are also shapes that have no lines of symmetry. Here are some examples:

**4. Example in Context**

Assume students are studying plant cells and take a microscopic look at onion cells to get a closer look of the cell structure. Of the full cells we can see in this view, how many lines of symmetry would there be?

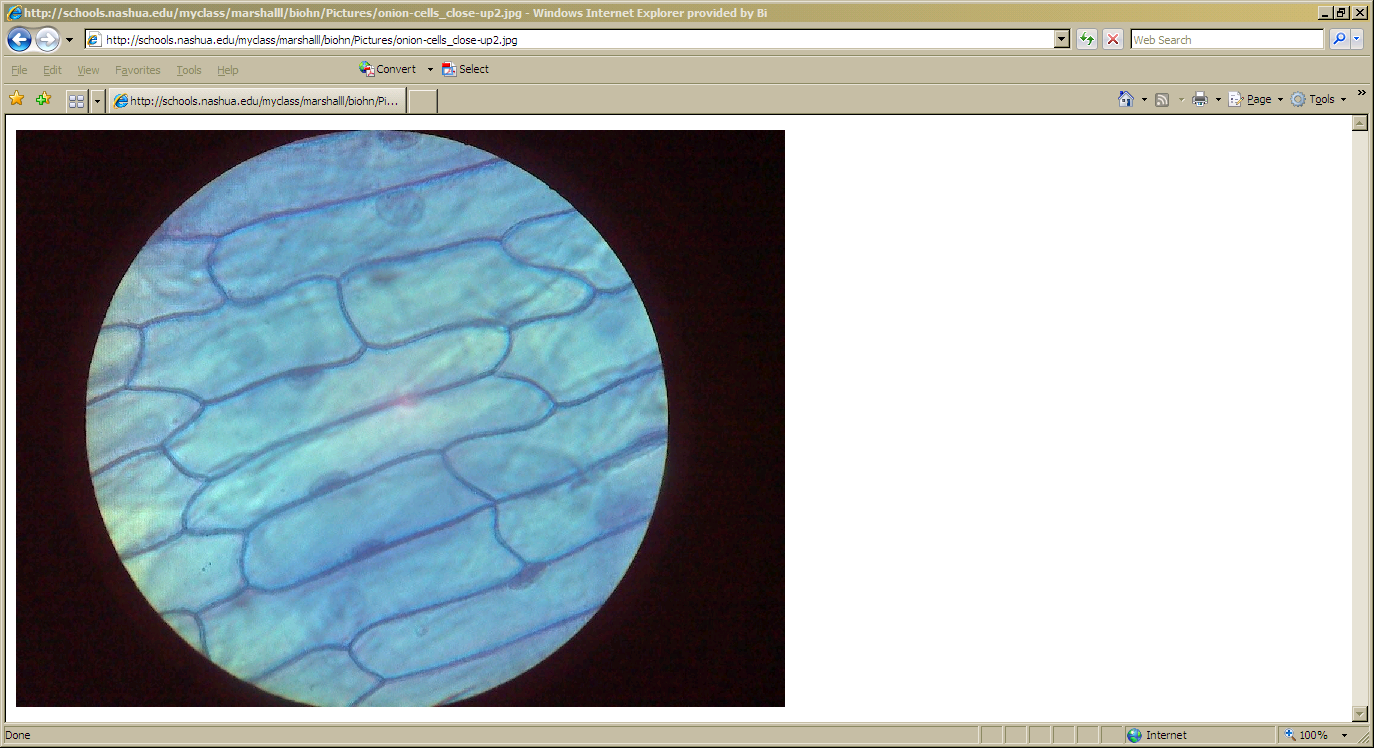
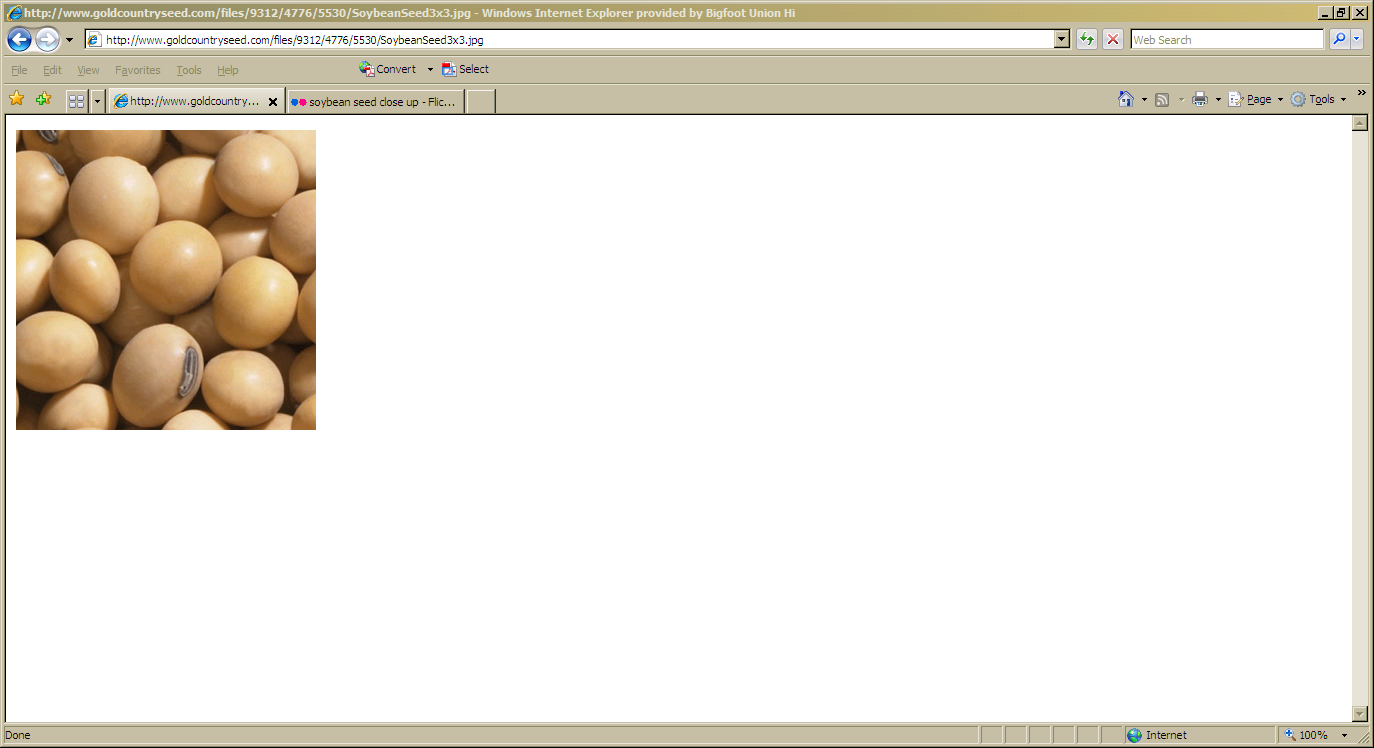
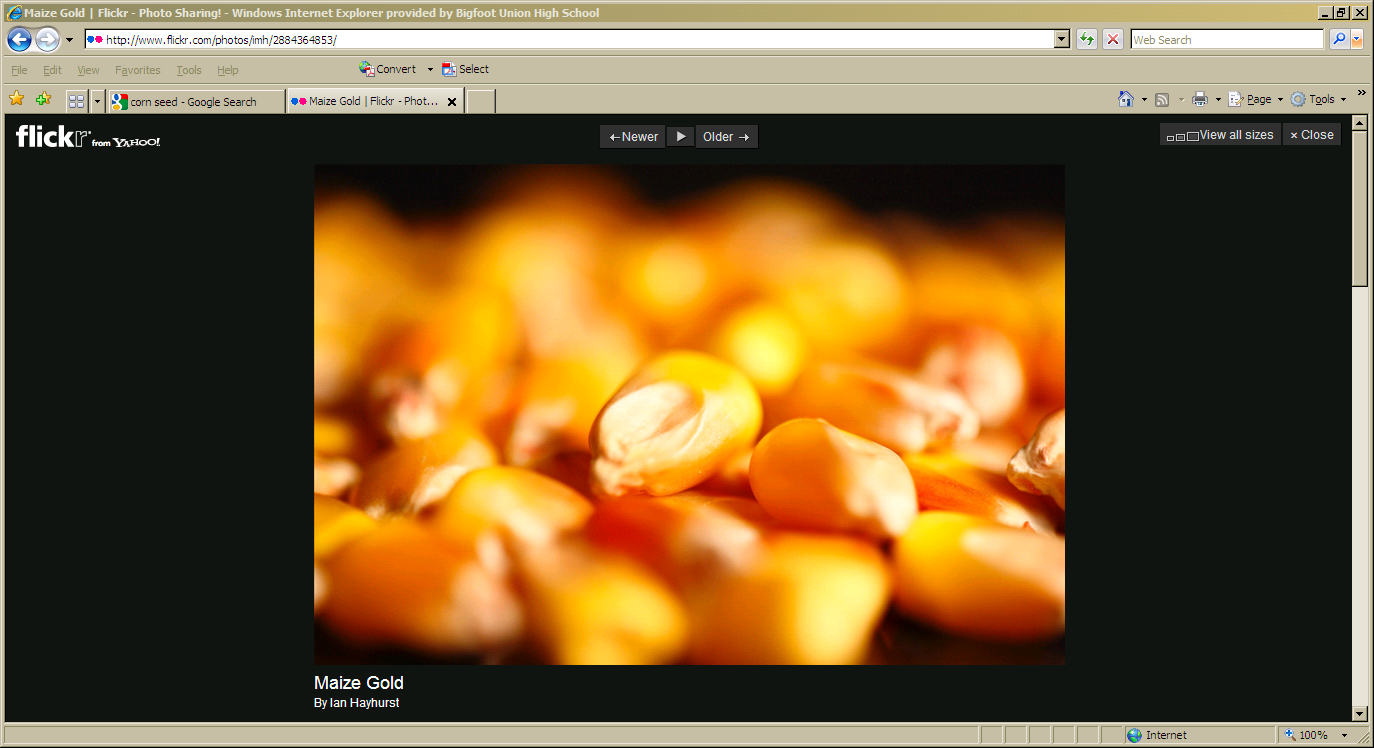
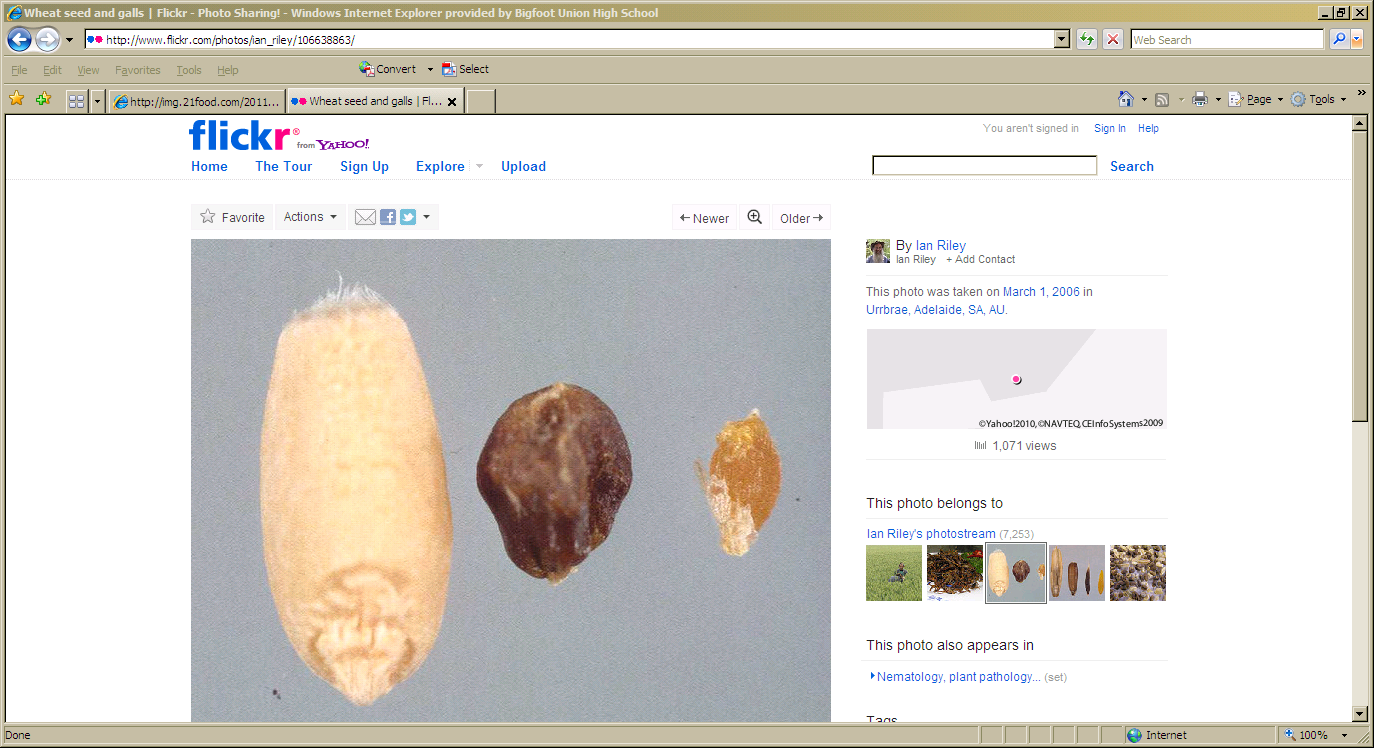


Image from: <http://schools.nashua.edu/myclass/marshalll/biohn/Pictures/onion-cells_close-up2.jpg>, retrieved: July 28, 2011.

*Answer: None. These onion cells do not have lines of symmetry.*

**5. Guided Practice Exercise**

Assume students are studying different kinds of seeds. How many lines of symmetry could they find on the corn, wheat, and soybean seed?



*Answer: Corn: 1, Wheat, 1, Soybean – if it is perfectly round, infinite.*

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**6. Independent Practice Exercises**

Assume students are studying monocot (corn) and dicot (bean) germination. After studying the images below, when is the only time during the germination process where all parts of the plant would have one or multiple lines of symmetry?

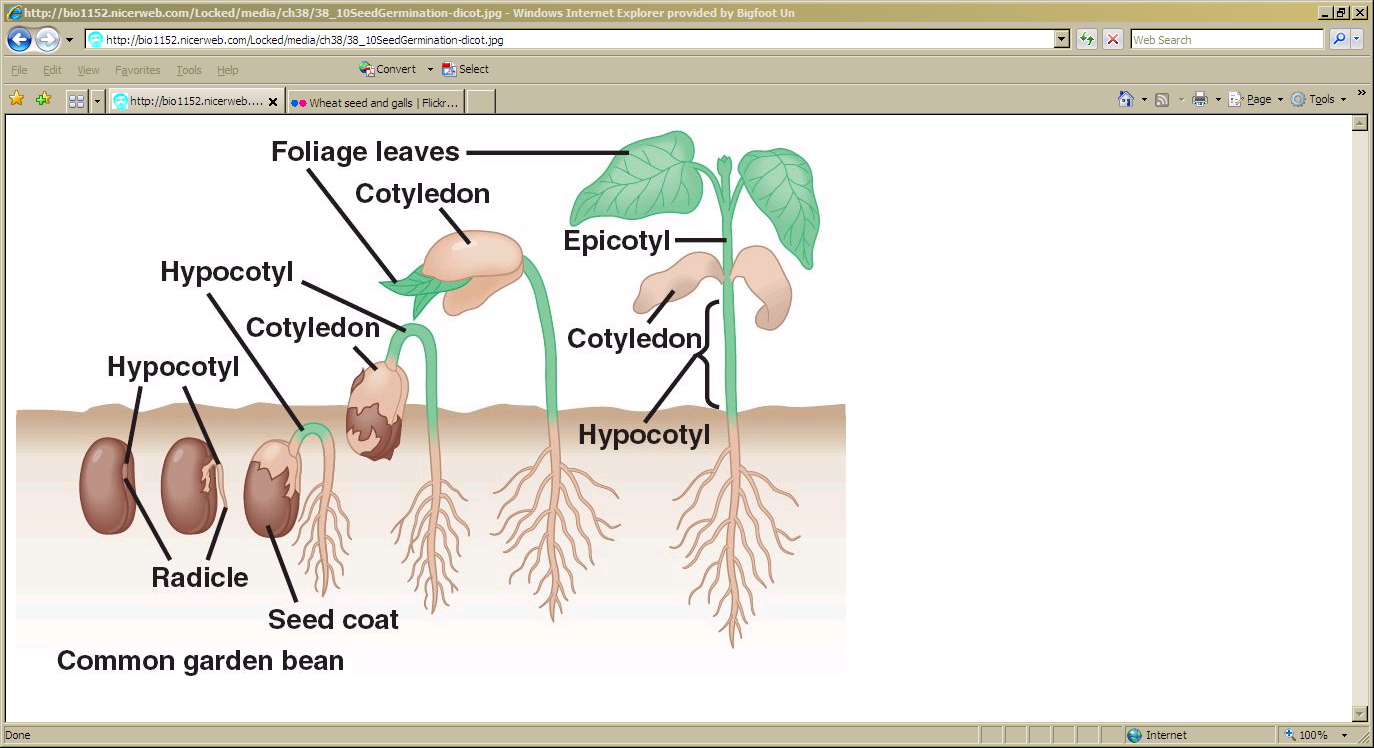
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Image from: <http://bio1152.nicerweb.com/Locked/media/ch38/38_10SeedGermination-dicot.jpg> retrieved: July 28, 2011

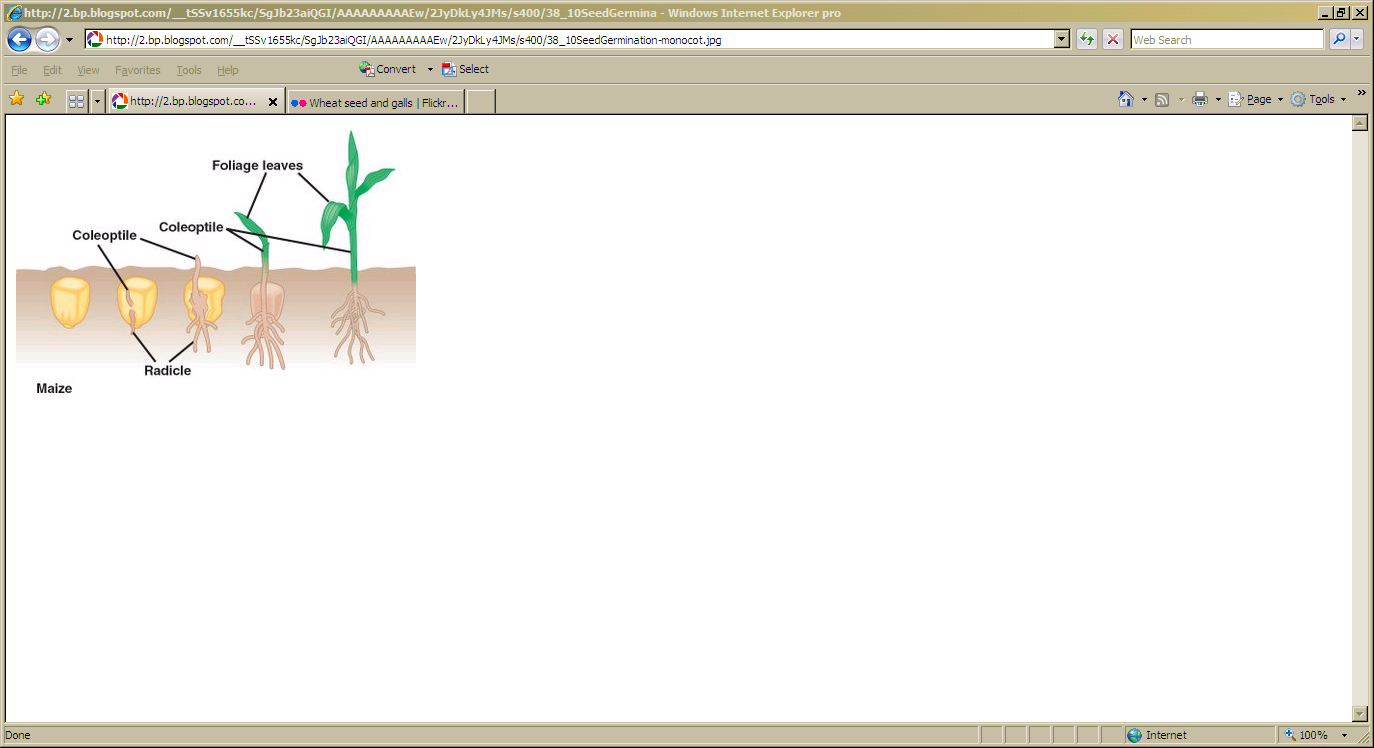
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Image from: <http://2.bp.blogspot.com/__tSSv1655kc/SgJb23aiQGI/AAAAAAAAAEw/2JyDkLy4JMs/s400/38_10SeedGermination-monocot.jpg> Retrieved, July 28, 2011

*Answer: While it is still a seed.*

Assume the sunflower below was cut in half along a line of symmetry. Draw the congruent side of the sunflower.



*Answer: an image similar to the one below*



**Image from:** [**http://farm2.static.flickr.com/1399/1084445061\_993666e8a8.jpg**](http://farm2.static.flickr.com/1399/1084445061_993666e8a8.jpg) **retrieved July 28, 2011**

**7. Notes**

Lines of symmetry can be found naturally in plants and could be used to teach geometry in a variety of ways. They could be used to classify plants, leaves, seeds, or identify steps of mitosis.